1 **WHAT IS CLAIMED IS:**

2 1.   An invert emulsion drilling fluid comprising

3   an oleaginous continuous phase

4   a non-oleaginous discontinuous phase

5   a surfactant is a fatty acid ester of diglycerol or triglycerol, and

6   a weighting agent.

7

8 2.   The invert emulsion drilling fluid of claim 1 wherein the surfactant is a di-fatty

9 acid ester of diglycerol and wherein fatty acid has the formula RCO_2H in which R is an

10 alkyl or akenyl having 10 to 20 carbon atoms.

11

12 3.   The invert emulsion drilling fluid of claim 1 wherein the surfactant is a di-fatty

13 acid ester of triglycerol and wherein fatty acid has the formula RCO_2H in which R is an

14 alkyl or akenyl having 10 to 20 carbon atoms.

15

16 4.   The drilling fluid of claim 1 wherein the oleaginous fluid is selected from diesel

17 oil, mineral oil, synthetic oil, ester oils, glycerides of fatty acids, aliphatic esters, aliphatic

18 ethers, aliphatic acetals, or other such hydrocarbons and combinations thereof.

19

20 5.   The drilling fluid of claim 1 wherein the non-oleaginous phase is selected from

21 fresh water, sea water, brine, aqueous solutions containing water soluble organic salts,

22 water soluble alcohols or water soluble glycols or combinations thereof.

23

24 6.   The drilling fluid of claim 1 wherein the weighting agent is a water soluble

25 weighting agent or a water insoluble weighting agent or combinations thereof.

26

27 7.   The drilling fluid of claim 6 wherein the water insoluble weighting agent is

28 selected from barite, calcite, mullite, gallena, manganese oxides, iron oxides, or

29 combinations thereof.

30

1   8.   The drilling fluid of claim 6 wherein the water soluble weighting agent is selected

2   from water soluble salts of zinc, iron, barium, calcium or combinations thereof.

3

4   9.   The drilling fluid of claim 1 wherein the surfactant is selected from polyglyceryl-2

5   diisostearate or polyglyceryl-3 diisostearate.

6

7   10.   An invert emulsion drilling fluid comprising

8   an oleaginous continuous phase

9   a non-oleaginous discontinuous phase,

10   a biodegradable surfactant including a di-fatty acid ester of diglycerol and wherein

11   fatty acid has the formula RCO_2H in which R is an alkyl or akenyl having 10 to 20 carbon

12   atoms, and

13   a weighting agent.

14

15   11.   The drilling fluid of claim 10 wherein the surfactant is polyglyceryl-2

16   diisostearate.

17

18   12.   An invert emulsion drilling fluid comprising

19   an oleaginous continuous phase

20   a non-oleaginous discontinuous phase,

21   a biodegradable surfactant including a di-fatty acid ester of triglycerol and

22   wherein fatty acid has the formula RCO_2H in which R is an alkyl or akenyl having 10 to

23   20 carbon atoms, and

24   a weighting agent.

25

26   13.   The drilling fluid of claim 12 wherein the surfactant is polyglyceryl-3

27   diisostearate.

28

29   13.   A method of formulating an invert emulsion drilling fluid, said method

30   comprising:

1   mixing an oleaginous fluid, a non-oleaginous fluid, a biodegradable surfactant and

2   a weighting agent, wherein the biodegradable surfactant includes a fatty acid ester of

3   diglycerol or triglycerol in amounts sufficient to form an invert emulsion in which the

4   oleaginous fluid is the continuous phase and the non-oleaginous fluid is the discontinuous

5   phase.

6

7   14.   The method of claim 13 wherein the a fatty acid ester of diglycerol or triglycerol

8   is a di-fatty acid ester of diglycerol and wherein fatty acid has the formula RCO_2H in

9   which R is an alkyl or akenyl having 10 to 20 carbon atoms

10

11   15.   The method of claim 13 wherein the a fatty acid ester of diglycerol or triglycerol

12   is a di-fatty acid ester of triglycerol and wherein fatty acid has the formula RCO_2H in

13   which R is an alkyl or akenyl having 10 to 20 carbon atoms

14

15   16.   The method of claim 13 wherein the oleaginous fluid is selected from diesel oil,

16   mineral oil, synthetic oil, ester oils, glycerides of fatty acids, aliphatic esters, aliphatic

17   ethers, aliphatic acetals, or other such hydrocarbons and combinations thereof.

18

19   17.   The method of claim 13 wherein the non-oleaginous phase is selected from fresh

20   water, sea water, brine, aqueous solutions containing water soluble organic salts, water

21   soluble alcohols or water soluble glycols or combinations thereof.

22

23   18.   The method of claim 13 wherein the weighting agent is a water soluble weighting

24   agent or a water insoluble weighting agent or combinations thereof.

25

26   19.   The method of claim 18 wherein the water insoluble weighting agent is selected

27   from barite, calcite, mullite, gallena, manganese oxides, iron oxides, or combinations

28   thereof.

29

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1   20.   The method of claim 18 wherein the water soluble weighting agent is selected

2   from water soluble salts of zinc, iron, barium, calcium or combinations thereof.

3

4   21.   A method of drilling a subterranean hole with an invert emulsion drilling fluid,

5   said method comprising:

6   mixing an oleaginous fluid, a non-oleaginous fluid, a biodegradable surfactant,

7   and a weighting agent to form an invert emulsion, wherein the biodegradable surfactant

8   includes a fatty acid ester of diglycerol or triglycerol in amounts sufficient to form an

9   invert emulsion in which the oleaginous fluid is the continuous phase and the non-

10   oleaginous fluid is the discontinuous phase, and

11   drilling said subterranean hole using said invert emulsion as the drilling fluid.

12

13   22.   The method of claim 20 wherein the a fatty acid ester of diglycerol or triglycerol

14   is a di-fatty acid ester of diglycerol and wherein fatty acid has the formula RCO_2H in

15   which R is an alkyl or akenyl having 10 to 20 carbon atoms.

16

17   23.   The method of claim 20 wherein the a fatty acid ester of diglycerol or triglycerol

18   is a di-fatty acid ester of triglycerol and wherein fatty acid has the formula RCO_2H in

19   which R is an alkyl or akenyl having 10 to 20 carbon atoms.

20

21   24.   The method of claim 20 wherein the oleaginous fluid is selected from diesel oil,

22   mineral oil, synthetic oil, ester oils, glycerides of fatty acids, aliphatic esters, aliphatic

23   ethers, aliphatic acetals, or other such hydrocarbons and combinations thereof.

24

25   25.   The method of claim 20 wherein the non-oleaginous phase is selected from fresh

26   water, sea water, brine, aqueous solutions containing water soluble organic salts, water

27   soluble alcohols or water soluble glycols or combinations thereof.

28

29   26.   The method of claim 20 wherein the weighting agent is a water soluble weighting

30   agent or a water insoluble weighting agent or combinations thereof.

27.   The method of claim 26 wherein the water insoluble weighting agent is selected from barite, calcite, mullite, gallena, manganese oxides, iron oxides, or combinations thereof.

28.   The method of claim 26 wherein the water soluble weighting agent is selected from water soluble salts of zinc, iron, barium, calcium or combinations thereof.

29.   A method of drilling a subterranean well with an invert emulsion drilling fluid, said method comprising:

mixing an oleaginous fluid, a non-oleaginous fluid, a biodegradable surfactant, and a weighting agent to form an invert emulsion, wherein the biodegradable surfactant includes a fatty acid ester of diglycerol, wherein the fatty acid has the formula RCO_2H in which R is an alkyl or akenyl having 10 to 20 carbon atoms and wherein the biodegradable surfactant is in amounts sufficient to form an invert emulsion in which the oleaginous fluid is the continuous phase and the non-oleaginous fluid is the discontinuous phase,

circulating said invert emulsion within said subterranean well and

drilling said subterranean well using said invert emulsion as the drilling fluid.

30.   The method of claim 29 wherein the fatty acid ester of diglycerol is a di fatty acid ester.

31.   The method of claim 30 wherein the fatty acid ester of diglycerol is polyglyceryl-2 diisostearate.

32.   A method of drilling a subterranean well with an invert emulsion drilling fluid, said method comprising:

mixing an oleaginous fluid, a non-oleaginous fluid, a biodegradable surfactant, and a weighting agent to form an invert emulsion, wherein the biodegradable surfactant

1   includes a fatty acid ester of triglycerol, wherein the fatty acid has the formula RCO$_2$H in

2   which R is an alkyl or akenyl having 10 to 20 carbon atoms and wherein the

3   biodegradable surfactant is in amounts sufficient to form an invert emulsion in which the

4   oleaginous fluid is the continuous phase and the non-oleaginous fluid is the discontinuous

5   phase,

6   circulating said invert emulsion within said subterranean well and

7   drilling said subterranean well using said invert emulsion as the drilling fluid.

8

9   33.   The method of claim 32 wherein the fatty acid ester of triglycerol is a di-fatty acid

10   ester.

11

12   34.   The method of claim 32 wherein the fatty acid ester of triglycerol is polyglyceryl-

13   3 diisostearate.

14

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